

HE
Appl. No. 10/507,112
September 18, 2006

Please amend the title at page 19, before claim 1 as follows:

CLAIMS:WHAT IS CLAIMED IS;

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) An automated computerized method for optimizing allocation of a set W of n tasks to m available resources for accomplishing such tasks using combinatorial multimodal optimization for finding multiple optimal ways of dividing a set W of n task values into m respectively groups associated with said resources, such that each of the groups satisfies a respective constraint condition, the method including execution of a computer program to automatically perform a series of machine operations comprising:
 - (a) receiving digital data signals representing plural tasks for assignment to available resources and, based thereon, defining an initial population of individuals, each representative of a trial solution assigning specific tasks to specific resources;
 - (b) calculating for each individual trial solution a fitness vector indicative of whether the constraint condition for each group has been satisfied;
 - (c) selecting a plurality of individual trial solutions for the next generation in dependence upon their respective fitness vectors;
 - (d) creating a new population of trial solutions including the selected individual earlier trial solutions; and

(e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individuals trial solutions of the stable population representing multiple optional ways of dividing the set W of tasks; and

(f) outputting at least one of said stabilized population as an optimized allocation of tasks to resources.

2. (Currently Amended) A method as-~~claimed~~ in claim 1 in which the fitness vector is of length m , each element in the fitness vector being indicative of whether the constraint condition of a corresponding one of the m groups has been satisfied.

3. (Currently Amended) A method as-~~claimed~~ in claim 2 in which the fitness vector comprises m bits, each bit being indicative of whether the constraint condition of a corresponding one of the m groups has been satisfied.

4. (Currently Amended) A method as-~~claimed~~ in claim 1 including calculating a fitness value for each individual trial solution.

5. (Currently Amended) A method as claimed in claim 3 including calculating a fitness value for each individual trial solution in which the fitness value comprises the sum of the bits in the fitness vector.

6. (Currently Amended) A method as-~~claimed~~ in claim 1 including reserving a proportion of the new population for individuals trial solutions selected at step (c).

7. (Currently Amended) A method as-~~claimed~~ 6 in which a non-reserved proportion of the new population is generated using a Roulette wheel selection method.
8. (Currently Amended) A method as-~~claimed~~ in claim 1 in which step (c) comprises selecting non-dominated individuals trial solutions using the criteria of Pareto optimality.
9. (Currently Amended) A method as-~~claimed~~ in claim 4 in which step (c) comprises selecting non-dominated individuals trial solutions using the criteria of Pareto optimality including ranking non-dominated individuals trial solutions by fitness value, and selecting from the ranked list.
10. (Currently Amended) A method as-~~claimed~~ in claim 9 in which only non-dominated individuals trial solutions with greatest fitness value may be selected at step (c).
11. (Currently Amended) A method as-~~claimed~~ in claim 4 in which step (c) comprises selecting individuals trial solutions in dependence upon both their respective fitness vectors and their respective fitness values.
12. (Currently Amended) A method as-~~claimed~~ in claim 1 in which crossover and mutation are applied at step (d) to at least some individuals trial solutions in the new population.

13. (Currently Amended) A method as ~~claimed~~ in claim 1 in which step (c) comprises selecting no more than one individual trial solution for each unique fitness vector.

14. (Currently Amended) An automated computerized method of distributing a plurality of tasks between a plurality of devices connected together to form a network, wherein each device has an associated constraint on the amount of tasks that it can perform per unit of time, the method including execution of a computer program to automatically perform a series of machine operations comprising:

(a) generating a plurality of trial solution allocations of tasks to devices to form an initial population of allocations;

(b) calculating for each allocation of tasks to devices a fitness vector indicative of whether the constraint condition for each device has been satisfied;

(c) selecting a plurality of allocations of tasks to devices for inclusion in the next generation of allocations in dependence upon their respective fitness vectors;

(d) creating the next generation of allocations of tasks to devices by including the allocations selected in step (c) together with new allocations, each of which is formed from a combination of two or more of the allocations selected in step (c);

(e) repeating steps (b) to (d) until the population stabilizes; and

(f) ~~allocating~~ outputting an allocation of the tasks among the devices according to one of the allocations included in the stabilized population.

15. (Currently Amended) A method as-~~claimed~~ in claim 14 wherein the devices are processors within a multi-processor computer system.

16. (Currently Amended) A method as-~~claimed~~ in claim 14 wherein the devices are computers within a computer network.

17. (Currently Amended) A method as-~~claimed~~ in claim 14 wherein the devices are routers and the tasks are estimated volumes of traffic to be routed through the routers within a data network, and wherein the allocations are used to form a routing strategy.

18. (Currently Amended) A method as-~~claimed~~ in claim 14 in which step (c) comprises selecting non-dominated allocations using the criteria of Pareto optimality of the associated fitness vectors.

19. (Currently Amended) A method as-~~claimed~~ in claim 1 in which new allocations are formed in step (d) by performing crossover operations in respect of groups of two or more of the allocations selected in step (c).

20. (Currently Amended) A method as-~~claimed~~ in claim 14 in which mutation operations are applied to one or more of the new allocations formed in step (d) according to a predetermined probability of each new allocation being mutated.

21. (Currently Amended) A tangible medium containing a computer program for carrying out the steps of claim 1 which, when executed effects a method for optimizing allocation of a set W of n tasks to m available resources for accomplishing such tasks using combinatorial multimodal optimization for finding multiple optimal ways of dividing said set W of n task values into m resource groups, such that each of the groups satisfies a respective constraint condition, the method including execution of a computer program to automatically perform a series of machine operations comprising:

- (a) defining an initial population of trial solutions;
- (b) calculating for each trial solution a fitness vector indicative of whether the constraint condition for each group has been satisfied;
- (c) selecting a plurality of trial solutions for the next generation in dependence upon their respective fitness vectors;
- (d) creating a new population of trial solutions including the selected earlier trial solutions;
- (e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individual trial solution of the stable population representing multiple optional ways of dividing the set W of tasks; and
- (f) outputting at least one of said stabilized population as an optimized allocation of tasks to resources.

22. Cancelled.

23. (Currently Amended) A system comprising a plurality of devices connected together to form a network, wherein each device has an associated constraint on the amount of tasks that it can perform per unit of time, the system including ~~means~~ an allocation subsystem for allocating a plurality of tasks among the devices, the allocation ~~means~~ subsystem comprising:

(a) means for generating a plurality of trial solution allocations to form an initial population of allocations;

(b) means for calculating for each allocation a fitness vector indicative of whether the constraint condition for each device has been satisfied;

(c) means for selecting a plurality of allocations for inclusion in the next generation of allocations in dependence upon their respective fitness vectors;

(d) means for creating the next generation of allocations by including the allocations selected in step (c) together with new allocations each of which is formed from a combination of two or more of the allocations selected in step (c);

(e) means for repeating steps (b) to (d) until the population stabilizes; and

(f) means for ~~allocating~~ outputting an allocation of the tasks among the devices according to one of the allocations included in the stabilized population.